

# **High-Definition Multimedia Interface**

**Version 2.0**

**Quantum Data MOI v1.0**

**Test ID: HF1-22**

July 24, 2015

# Preface

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## Document Revision History

1.0 July 24, 2015 - Initial Release.

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## Contact Information

The URL for the HDMI Forum web site is: <http://www.hdmiforum.org/>

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# Introduction

This document provides a set of Method of Implementation for test method described in HDMI Compliance Test Specification Version 2.0 (HDMI CTS 2.0). HDMI Forum created HDMI CTS 2.0 to specify a set of tests that should be performed to verify features described in HDMI Specification Version 2.0.

## Scope

This document provides testing procedures for HDMI CTS 2.0 Test ID HF1-22: Source TMDS Protocol – 6G – Non-2160p Basic Protocol and Scrambling.” The procedure below deals with single resolution and only one Test ID is considered at a time.

## References

### Normative References

High-Definition Multimedia Interface Specification Version 1.4b, October 11, 2011.  
HDMI Compliance Test Specification Version 1.4b, October 11, 2011.  
High-Definition Multimedia Interface Specification Version 2.0, August, 2013.  
HDMI Compliance Test Specification Version 2.0.

### Informative Reference

No additional informative references.

## Test ID HF1-22: Source TMDS Protocol – 6G – Non-2160p Basic Protocol and Scrambling

### Objective

Confirm that the Source only outputs code sequences for Control Periods, Data Island Periods and Video Data Periods corresponding to the basic HDMI protocol rules.

Table 7-29 Source TMDS Protocol – 6G – Non-2160p Basic Protocol & Scrambling Requirements

Reference	Requirement
[HDMI: 5.2.1] Control Period	<See reference for details>
[HDMI: 5.2.1.1] Preamble	<See reference for details>
[HDMI: 5.2.2] Video Data Period	<See reference for details>
[HDMI: 5.2.3] Data Island Period	<See reference for details>
[HDMI 2.0: 6.1.2] Scrambling for EMI/RFI Reduction	<See reference for details>
[HDMI 2.0: 6.1.3.1] Scrambling Control	<See reference for details>

### Capability(s)

The Source DUT supports at least one Video Timing/color mode with a TMDS Character Rate greater than 340Mcsc.

### Test Equipment

Item	Generic Equipment	Vendor Specific Equipment	Quantity
1	HDMI 2.0 Protocol Analyzer	980 Advanced Test Platform series: 980 HDMI 2.0 Protocol Analyzer module HDMI CTS 2.0 Compliance Test Package #3	1

### Generic Procedure

- 1 If the CDF field Source\_Above\_340 is “N”, then SKIP this test.  
Setup:
- 2 Connect the Source DUT to the Protocol Analyzer.
- 3 Configure the EDID, which indicates all Video Timings necessary for this test.  
Measure:
- 4 For a Video Timing with the lowest DUT-supported TMDS Character Rate above 340Mcsc (selected from the timings declared in the CDF fields Source\_2160p\_3D\_Video\_Formats\_Above\_340, Source\_non\_2160p\_Video\_Formats\_Above\_340\_DC or Source\_non\_2160p\_Video\_Formats\_Above\_340\_3D, perform the following:
  - 4.1 Operate the Source DUT to output the tested format.
  - 4.2 If the Source DUT does not write 1 to the Scrambling\_Enable bit, then FAIL.
  - 4.3 Capture and find a sequence of unscrambled Control Period encoded characters.

- 4.3.1 If the number of unscrambled control codes is greater than 8, then FAIL.
  - 4.3.2 If the number of unscrambled control codes is less than 8, then FAIL.
  - 4.3.3 If more than one or no unscrambled control period per field exist, then FAIL.
  - 4.4 After descrambling the data (except for one unscrambled Control Period per field), verify the tested format as follows:
  - 4.5 Suspend HDCP functionality (if present) and examine the CTL3:CTL2:CTL1:CTL0 values for the 16 (Control-encoded) Pixels during the HDCP-specified window of opportunity. If the ENC\_EN code (CTL0:3=1001) is included, then FAIL.
  - 4.6 For every transition from a character with Control Period Coding to a subsequent character using any other (non-Control) encoding:
    - 4.6.1 Examine the CTL3:CTL2:CTL1:CTL0 values for the 8 (Control-encoded) Pixels immediately prior to the transition and compare them to the values 0b0001 (Video Data Period Preamble) and 0b0101 (Data Island Preamble).
- [Check for Invalid Data Island Preamble control code usage]
- 4.6.2 Examine the whole control period prior to the Preamble. If the period includes a Data Island Preamble control code (CTL0:3=1010), then FAIL.
- [Inconsistent Preamble]
- 4.6.3 If any of the 8 Pixels does not match the CTLx value for any of the other Pixels, then FAIL.
- [Illegal Preamble]
- 4.7 If the Preamble value is neither a Data Island Preamble nor a Video Data Preamble, then FAIL.
  - 4.8 If the Preamble value is a Data Island Preamble:
    - 4.8.1 Examine the first two Pixels following the Preamble (Leading Guard Band).
      - 4.8.1.1 If TMDS channel 0 for either of these Pixels does not equal one of the 4 permitted Data Island Guard Band characters (0xC, 0xD, 0xE, 0xF), then FAIL.
      - 4.8.1.2 If TMDS channel 1 or 2 for either of these Pixels does not equal the specified Data Island Guard Band character (0b01010101), then FAIL.
    - 4.8.2 Scan through the following Pixels, while counting them, until there is a transition to Control Period Coding. Verify that every character is encoded with Data Island Coding.
    - 4.8.3 Examine the last two Pixels preceding this transition (Trailing Guard Band).

- 4.8.3.1 If TMDS channel 0 for either of these Pixels does not equal one of the 4 permitted Data Island Guard Band characters (0xC, 0xD, 0xE, 0xF), then FAIL.
  - 4.8.3.2 If TMDS channel 1 or 2 for either of these Pixels does not equal the specified Data Island Guard Band character (0b01010101), then FAIL.
- 4.8.4 If any character following the Leading Guard Band but preceding the Trailing Guard Band is not a legal TERC4 code, then FAIL.
- 4.8.5 If the first character following the Leading Guard Band has TERC4 ch. 0, bit3 equal to 1, then FAIL.
- 4.8.6 If any other character prior to the Trailing Guard Band has TERC4 ch. 0, bit3 not equal to 1, then FAIL.
- 4.8.7 The length of Data Island is equal to the number of Pixels following the Leading Guard Band and prior to the Trailing Guard Band. The Number of packets = Length of Data Island / 32.
  - 4.8.7.1 If the Number of packets is not an integer, then FAIL.
  - 4.8.7.2 If the Number of packets is equal to 0, then FAIL.
  - 4.8.7.3 If the Number of packets is greater than 1319 18, then FAIL.
  - 4.8.7.4 For every packet within the Data Island:
    - 4.8.7.4.1 For each of the 5 ECC blocks within the packet: If the BCH parity bits are incorrect, then FAIL.
- 4.9 If the Preamble value is Video Data Preamble:
  - 4.9.1 Examine the first two Pixels following the Preamble. If either of these Pixels does not equal the Video Data Guard Band character (TMDS channel0 and 2: 0b10101011, TMDS channel1: 0b01010101), then FAIL.
  - 4.9.2 Scan through the following Pixels until there is a transition to Control Period Coding. Verify that every character is encoded with Video Data Coding.
  - 4.9.3 If any character following the Video Guard Band up to this transition is not a correctly encoded Video Data code, then FAIL.

## Vendor Specific Test Procedure

### Test Equipment

A variety of equipment is needed for testing HDMI products. Each piece is authorized and included by name in this Compliance Test Specification. This section describes the Quantum Data test equipment.

#### HDMI 2.0 Protocol Analyzer module

The Quantum Data 980 HDMI 2.0 Protocol Analyzer module can be installed in the 980B or 980R series Advanced Test Platforms. This 980 HDMI 2.0 Protocol Analyzer module serves the generic test functions called out in the HDMI 2.0 Generic CTS. Refer to the table below:

Item	Quantum Data Equipment	
1	980 Advanced Test Platform series:	
	Equipped with:	980 HDMI 2.0 Protocol Analyzer module
		HDMI CTS 2.0 Compliance Test Package #3

#### 980 HDMI 2.0 Protocol Analyzer Module with 980 Series Platform Configurations

The figures below show depictions of the 980 HDMI 2.0 Protocol Analyzer module equipped in various 980 series platforms. **Note:** Card positioning may vary depending on configuration.



#### Source TMDs Protocol – 6G – Non-2160p Basic Protocol

#### Test ID HF1-22: Source TMDs Protocol – 6G – Non-2160p Basic Protocol and Scrambling



### 1. Objective

Confirm that the Source, whenever transmitting any 2160p Video Format for TMDS Character Rate above 340Mcsc up to 600Mcsc, transmits an accurate AVI InfoFrame at least once per every two video fields and appropriate color depth as indicated by GCP.

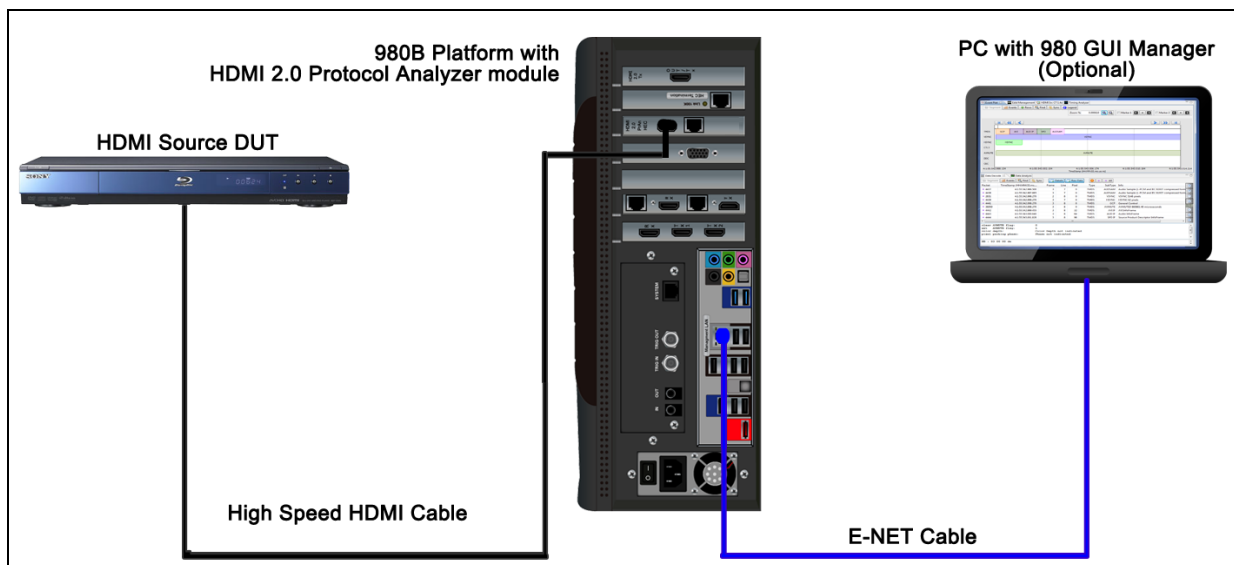
### 2. Test Overview

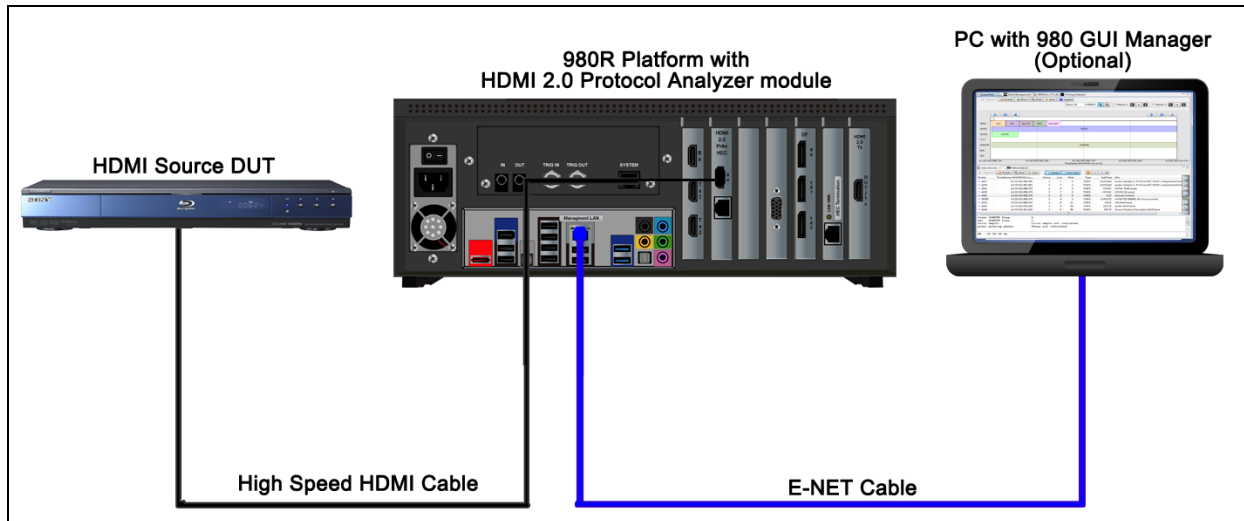
The Pass/Fail criteria is assessed by the application with no human examination required.

### 3. Procedure

Use the following procedure to conduct this test.

- 1 Connect Source DUT to the Quantum Data 980 HDMI 2.0 Protocol Analyzer at the module's port labeled Rx. Use a High Speed HDMI cable. The figures below show depictions of connections to the 980 HDMI 2.0 Protocol Analyzer module residing in the 980 series chassis.

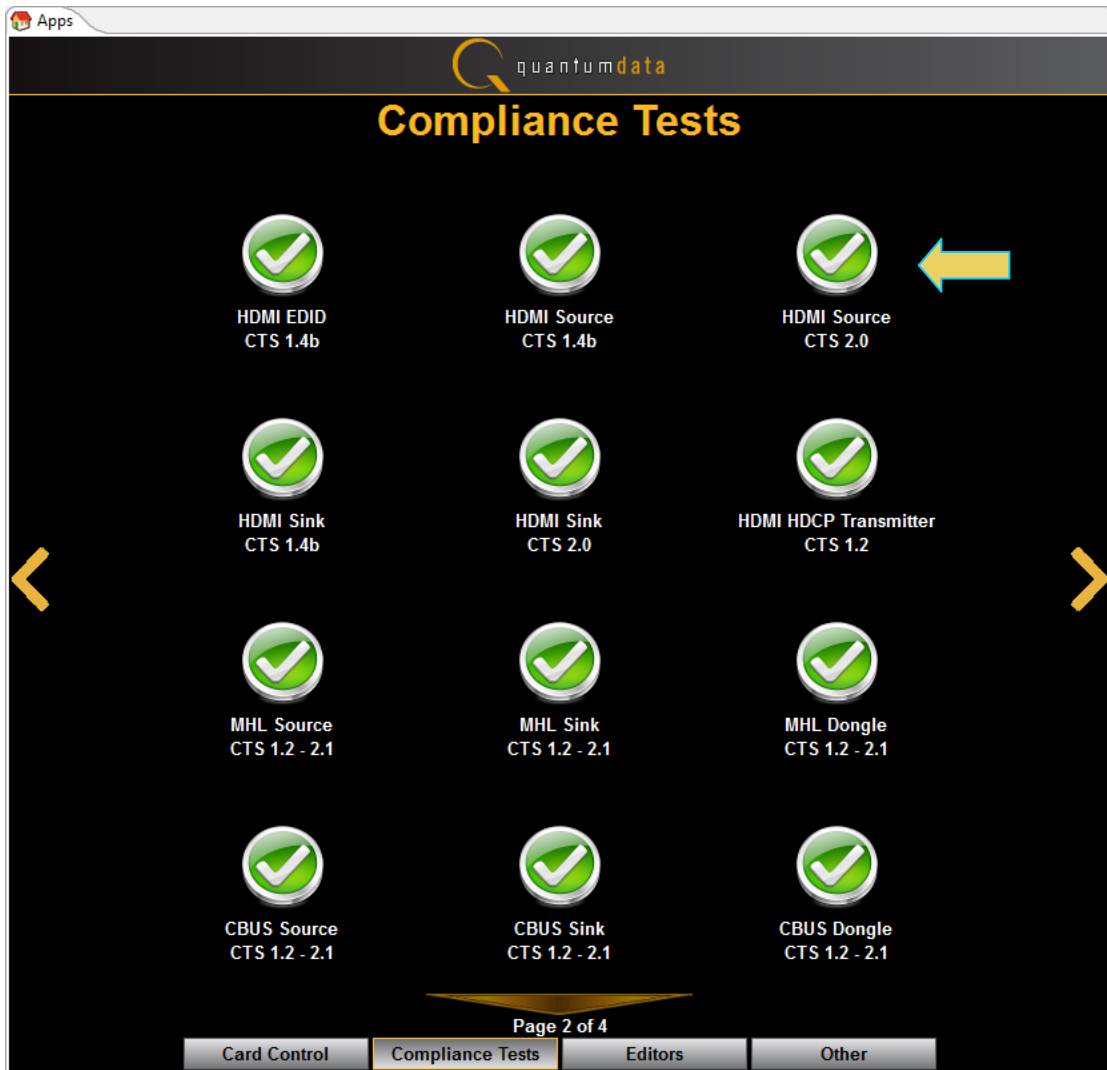




- 2 Operate the Source DUT to output the supported 3D formats.
- 3 Use Quantum Data 980 Embedded Manager GUI (touchscreen) or invoke Quantum Data 980 External Manager GUI (Windows application).

**Note:** You will not need to connect the PC shown in the figures above if you are running the compliance test through the 980's embedded display. The PC running the 980 HDMI 2.0 Protocol Analyzer module's compliance test application is connected to the 980 through a standard Ethernet cable.

- 4 Complete the following steps:
  - 4.1 Click on the HDMI Source CTS 2.0 icon in the Compliance Tests page of the Apps panel.



- 4.2 Navigate to the CDF tab if not already there. If there is a saved CDF file, then click on Open and select it. Otherwise, enter the DUT's CDF information for each tab and optionally click on Save to save the CDF.

HDMI 2.0 Src CT 2.0

CDF Entry Test Selection Test Options / Preview

Open New Save CDF File: /CDF/XYZ\_Source

General Y420 Video 21:9 (64:27) Video 6G Video 50p Timings

Source\_ITURBT\_2020\_101 Does the DUT support ITU-R BT.2020 Y'CC'BCC'RC Colorimetry?  
☐ Yes ☒ No

Source\_ITURBT\_2020\_110 Does the DUT support ITU-R BT.2020 Y'C'BC'R Colorimetry?  
☐ Yes ☒ No

Source\_LTE\_340Mscs\_Scrambling Does the product support scrambling for TMDS Character Rates at or below 340Mscs?  
☐ Yes ☒ No

Source\_Above\_340 Does the product support any Video Format/color mode for TMDS Character Rate above 340Mscs up to 600Mscs?  
☒ Yes ☐ No

Source\_2160p\_Video\_Formats\_Above\_340

(96) 3840x2160p @ 50 Hz 16:9	<input checked="" type="radio"/> Yes <input type="radio"/> No
(97) 3840x2160p @ 60 Hz 16:9	<input checked="" type="radio"/> Yes <input type="radio"/> No
(101) 4096x2160p @ 50 Hz 256:135	<input type="radio"/> Yes <input checked="" type="radio"/> No
(102) 4096x2160p @ 60 Hz 256:135	<input type="radio"/> Yes <input checked="" type="radio"/> No
(106) 3840x2160p @ 50 Hz 64:27	<input checked="" type="radio"/> Yes <input type="radio"/> No
(107) 3840x2160p @ 60 Hz 64:27	<input checked="" type="radio"/> Yes <input type="radio"/> No

Source\_2160p\_DC\_Video\_Formats\_Above\_340

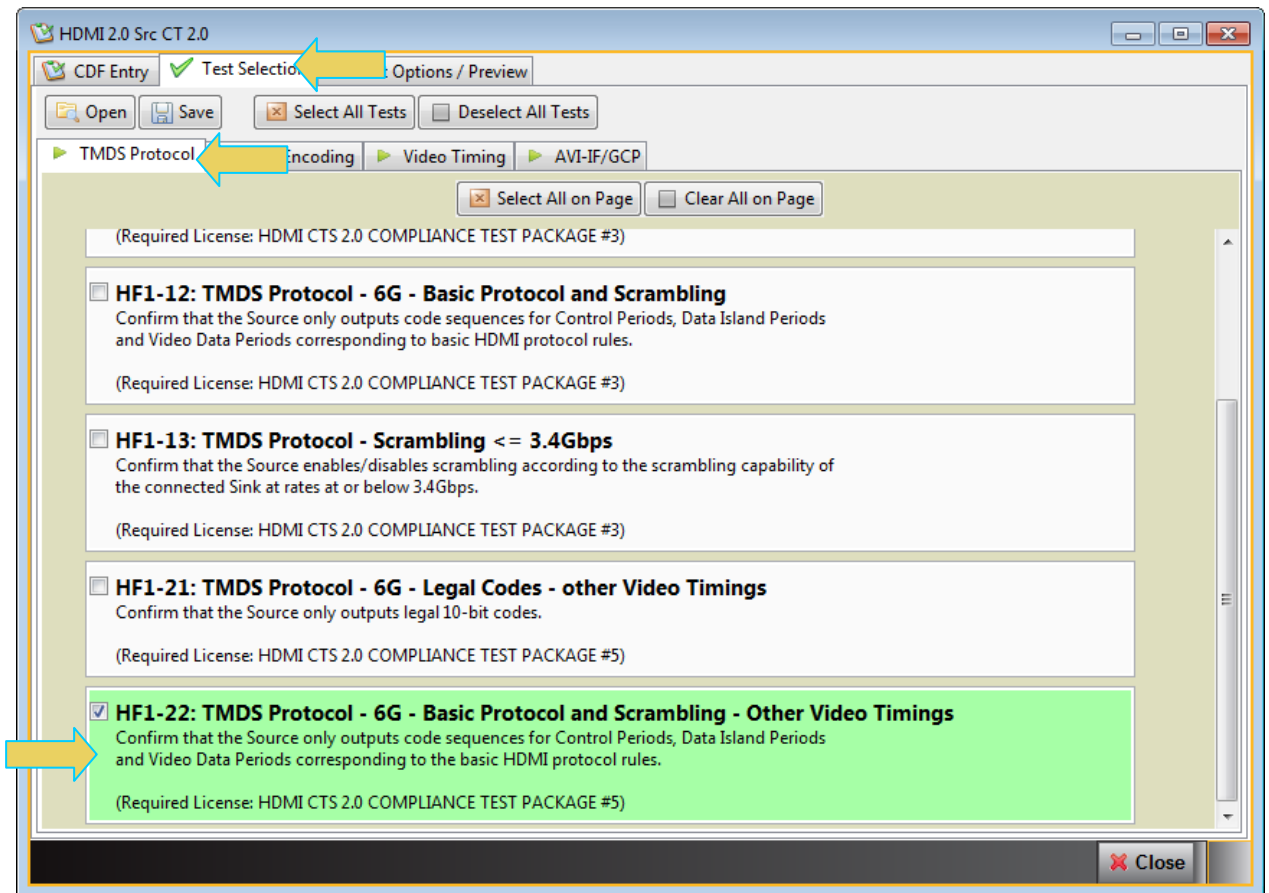
Format	30	36	48	(bits per pixel)
(93) 3840x2160p @ 24 Hz 16:9	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(bits per pixel)
(94) 3840x2160p @ 25 Hz 16:9	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(bits per pixel)
(95) 3840x2160p @ 30 Hz 16:9	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(bits per pixel)
(98) 4096x2160p @ 24 Hz 256:135	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	(bits per pixel)
(99) 4096x2160p @ 25 Hz 256:135	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	(bits per pixel)
(100) 4096x2160p @ 30 Hz 256:135	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	(bits per pixel)
(103) 3840x2160p @ 24 Hz 64:27	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	(bits per pixel)
(104) 3840x2160p @ 25 Hz 64:27	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	(bits per pixel)
(105) 3840x2160p @ 30 Hz 64:27	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	(bits per pixel)

Source\_2160p\_3D\_Video\_Formats\_Above\_340

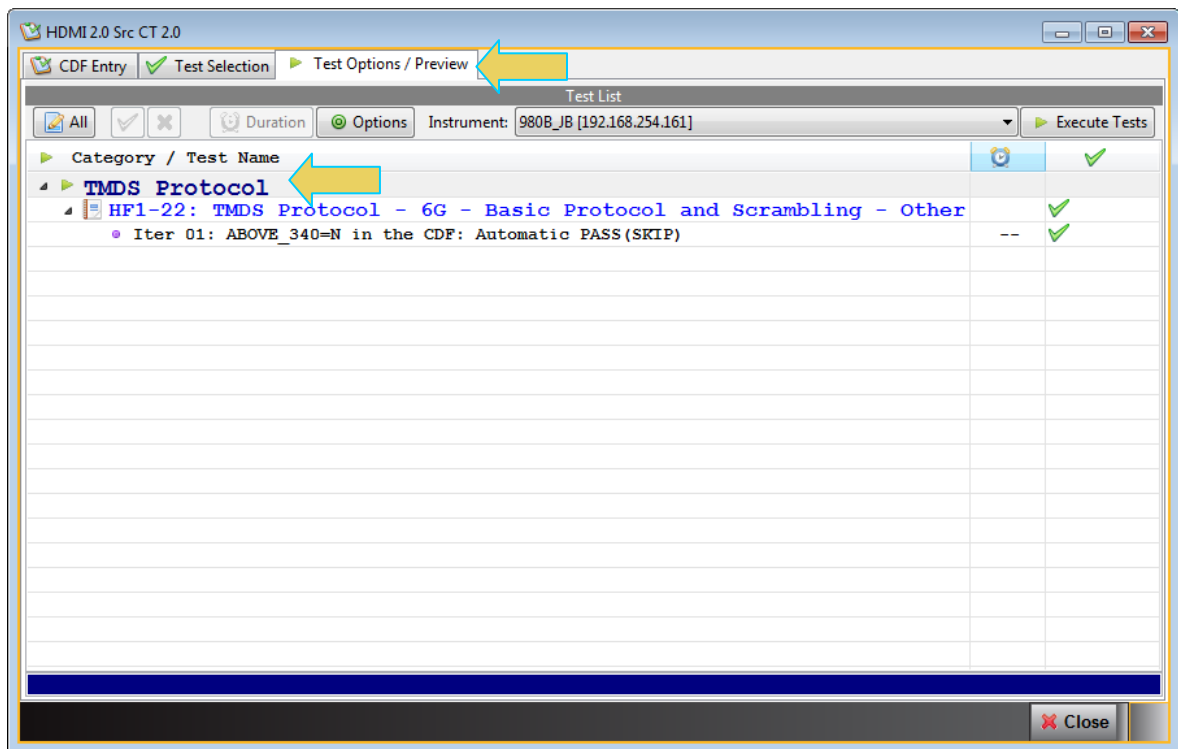
(95) 3840x2160p @ 30 Hz 16:9 - Frame Packing	<input type="radio"/> Yes <input checked="" type="radio"/> No
(94) 3840x2160p @ 25 Hz 16:9 - Frame Packing	<input type="radio"/> Yes <input checked="" type="radio"/> No
(93) 3840x2160p @ 24 Hz 16:9 - Frame Packing	<input type="radio"/> Yes <input checked="" type="radio"/> No
(98) 4096x2160p @ 24 Hz 256:135 - Frame Packing	<input type="radio"/> Yes <input checked="" type="radio"/> No
(100) 4096x2160p @ 30 Hz 256:135 - Frame Packing	<input type="radio"/> Yes <input checked="" type="radio"/> No
(99) 4096x2160p @ 25 Hz 256:135 - Frame Packing	<input type="radio"/> Yes <input checked="" type="radio"/> No
(97) 3840x2160p @ 60 Hz 16:9 - Side-by-Side (Half)	<input checked="" type="radio"/> Yes <input type="radio"/> No
(96) 3840x2160p @ 50 Hz 16:9 - Side-by-Side (Half)	<input checked="" type="radio"/> Yes <input type="radio"/> No

Close

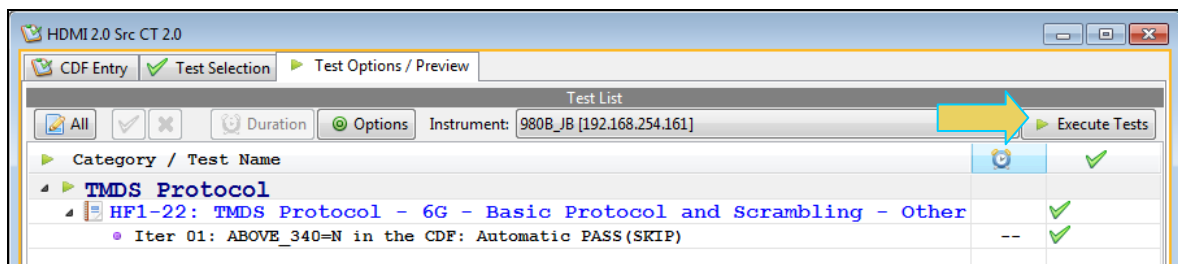
- 4.3 Click on the Test Selection tab and the TMDS Protocol sub tab and select the Test ID HF1-22: Source TMDS Protocol – 6G – Non-2160p Basic Protocol and Scrambling Test. Refer to the sample screen below.



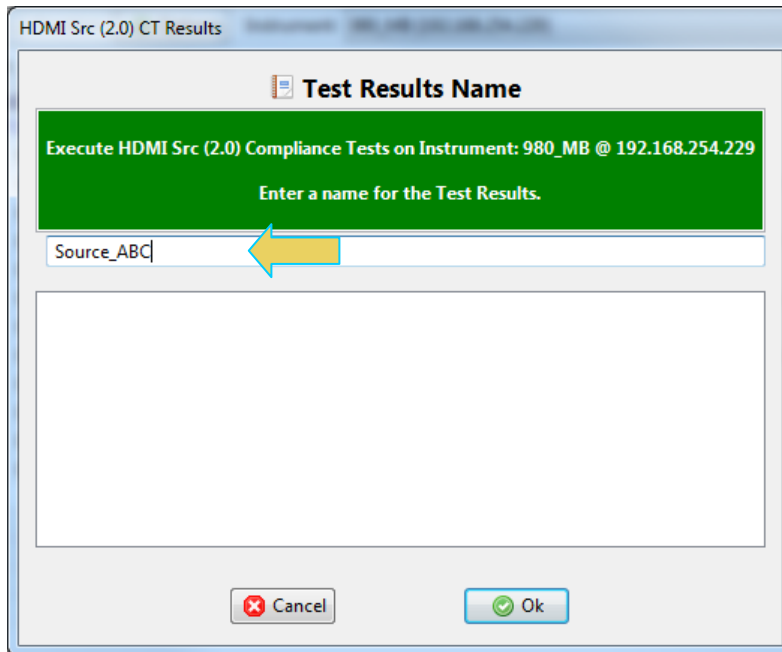
- 4.4 Click on Test Options / Preview tab and review the list of tests. Refer to the sample screen below.



- 4.5 Click on Execute tests activation button to initiate the test. Refer to the sample screen below.



**Note:** You will be prompted with a dialog box to assign a name to the test results. Refer to the screen example below:



Enter a name, click OK and the test will begin.

A Test Window will appear (below) indicating the progress of the test.

You will be prompted with a dialog box informing you of the requirements of the source DUT. Verify that the source is outputting the required HDMI format and pixel encoding and press Continue to run the test.

- 5 If the 980 HDMI Protocol Analyzer's compliance test application reports PASS, then PASS.  
If the 980 HDMI Protocol Analyzer's compliance test application reports FAIL, then FAIL.

